CLAIMS

1. An apparatus for capillary electrophoresis, comprising:

an inlet chamber;

a capillary electrophoresis column, having a length of at least about 20 centimeters, one end of the column being fixed at the interior of the inlet chamber; and

a liquid source adapted for automatic control, that supplies a liquid sample through an input valve into the inlet chamber, the sample supplied to be in fluid communication with the end of the column.

2. The apparatus of Claim 1, further comprising an outlet valve located at the inlet chamber.

3. The apparatus of Claim 1, wherein the sample source pressurizes the inlet chamber to create a pressure differential across the length of the column.

4. The apparatus of Claim 1, further comprising an outlet chamber, the other end of the column being fixed at the interior of the outlet chamber.

5. The apparatus of Claim 4, wherein the sample source pressurizes one chamber compared to the other chamber to create a pressure differential across the length of the column.

6. The apparatus of Claim 5, the liquid source further comprising a reservoir supplying a cleaning solution.

7. The apparatus of Claim 6, the liquid source further comprising a mechanical pump.

8. The apparatus of Claim 4, further comprising an output valve at each chamber that is controlled to independently remove liquid from each chamber.

9. The apparatus of Claim 8, further comprising at least one reservoir supplying a buffer, the liquid source independently supplying the buffer to the chambers.

10. The apparatus of Claim 9, further comprising a fluid level sensor at each chamber.

11. The apparatus of Claim 10, further comprising a filter to separate at least a portion of insoluble components from the liquid sample, the liquid source applying the liquid to the filter with a pressure differential across the filter.

12. The apparatus of Claim 4, further comprising electrophoresis electrodes coupled to an automatically controlled power supply.

13. The apparatus of Claim 12, further comprising a heat exchanger in thermal contact with the column.

14. The apparatus of Claim 13, further comprising a degas unit that removes at least a portion of gas dissolved in the liquid.

15. The apparatus of Claim 14, further comprising an automated detector that detects a molecular analyte in the liquid.

16. The apparatus of Claim 15, wherein the detector is located at the column.

17. The apparatus of Claim 16, further comprising an automated controller.

18. An apparatus for capillary electrophoresis, comprising:

a hydraulic system adapted for control by an automated controller, comprising a pump and one or more valves;

a rough filter selected to separate from a macromolecule in a liquid mixture, at least a portion of one or more rough components in the mixture that are larger than the macromolecule;

a fine filter selected to separate from the macromolecule, at least a portion of one or more fine components in the mixture that are smaller than the macromolecule;

an inlet chamber that receives a liquid sample filtered by the rough and fine filters, the sample comprising the macromolecule;

a capillary electrophoresis column, having a length of at least about 20 centimeters, one end of the column being fixed at the interior of the inlet chamber; and

the hydraulic system being controlled to create the liquid sample, the sample comprising the macromolecule, by applying the liquid mixture to each filter, with a pressure differential across each filter, and to supply the liquid sample to the inlet chamber.

19. An apparatus for capillary electrophoresis, comprising:

a hydraulic system adapted for control by an automated controller, comprising a pump and one or more valves;

a filter selected to separate, at least in part, a macromolecule in a liquid mixture from one or more salt components in the mixture;

an inlet chamber that receives a liquid sample, the sample comprising the macromolecule separated from the salt components;

a capillary electrophoresis column, having a length of at least about 20 centimeters, one end of the column being fixed at the interior of the inlet chamber; and

an automated controller that controls the hydraulic system to create the liquid sample, the sample comprising the macromolecule, by applying the liquid mixture to the filter, with a pressure differential across the filter, and to supply the sample to the inlet chamber.

20. An apparatus for capillary electrophoresis, comprising:

a hydraulic system adapted for control by an automated controller, comprising a pump and one or more valves;

a lysis unit that lyses cells in a liquid mixture comprising cells and a macromolecule;

a filter selected to separate from the macromolecule, at least a portion of components in the mixture that are larger than the macromolecule, the components comprising insoluble lysed cell components;

an inlet chamber that receives a liquid sample, the sample comprising a macromolecule separated from the insoluble lysed cell components;

a capillary electrophoresis column, having a length of at least about 20 centimeters, one end of the column being fixed at the interior of the inlet chamber; and

an automated controller that controls the hydraulic system to create the liquid sample, the sample comprising the macromolecule, by applying the liquid mixture to the filter, with a pressure differential across the filter, and to supply the sample to the inlet chamber

21. An apparatus for capillary electrophoresis, comprising:

an inlet chamber and an outlet chamber, the chambers each comprising an inlet valve, an output valve, a fluid level sensor, and an electrode, the electrodes coupled to a power supply;

a capillary electrophoresis column, having a length of at least about 20 centimeters, the opposite ends of the column being fixed at the interior of the respective chambers;

a liquid source comprising a pump and at least one valved reservoir supplying a buffer, the liquid source being coupled to the input valves; and

an automated controller that controls:

the liquid source and at least one valve to create a pressure differential across the length of the column by pressurizing or depressurizing at least one chamber;

the liquid source, the output valves, the valved reservoir, and the level sensors to independently:

drain the chambers;

supply the chambers with liquid to place the liquid in fluid communication with the end of the column in each chamber, including supplying:

the buffer to the outlet chamber; and

independently to the inlet chamber; the buffer and a liquid sample, the liquid sample comprising a macromolecule; and

a power supply to apply a voltage differential across the column to cause electrophoresis of the macromolecule in the column.

22. The apparatus of Claim 21, further comprising an automated detector that detects the macromolecule.

23. The apparatus of Claim 22, the liquid source further comprising:

a hydraulic system adapted for control by an automated controller, comprising a pump and one or more valves;

a rough filter selected to separate from the macromolecule in a liquid mixture comprising the macromolecule, at least a portion of one or more rough components in the mixture that are larger than the macromolecule;

a fine filter selected to separate from the macromolecule from the macromolecule in a liquid mixture comprising the macromolecule, at least a portion of one or more fine components in the mixture that are smaller than the macromolecule; and

the hydraulic system being controlled to create the liquid sample, the liquid sample comprising the macromolecule, by applying the liquid mixture to each filter, with a pressure differential across each filter.

24. A method for capillary electrophoresis, comprising automatically supplying a liquid sample through a valve to an inlet chamber to place the sample in fluid communication with a capillary electrophoresis column, the chamber having one end of the column fixed at the interior of the chamber, and the column having a length of at least about 20 centimeters.

25. The method of Claim 24, further comprising pressurizing the inlet chamber to create a pressure differential across the length of the column.

26. The method of Claim 24, the other end of the column being fixed at the interior of an outlet chamber, further comprising directing fluid through the column by creating a pressure differential between the chambers.

27. The method of Claim 26, further comprising creating a pressure differential by electro-kinetic pumping.

28. The method of Claim 26, further comprising creating a pressure differential by mechanical pumping.

29. The method of Claim 26, further comprising independently directing liquid from each chamber to a waste site.

30. The method of Claim 29, further comprising independently supplying a buffer to each chamber.

31. The method of Claim 30, further independently sensing the fluid level in at least one chamber.

32. The method of Claim 31, further comprising separating at least a portion of insoluble components from the liquid sample by applying the liquid to a filter with a pressure differential across the filter.

33. The method of Claim 26, further comprising applying a voltage differential across the column to create electrophoretic flow in the column.

34. The method of Claim 33, further comprising cooling the column.

35. The method of Claim 34, further comprising degassing at least a portion of gas dissolved in the liquid sample and the buffer.

36. The method of Claim 26, further comprising detecting a molecular analyte in the liquid sample.

37. The method of Claim 36, the molecular analyte being a macromolecule.

38. A method for capillary electrophoresis comprising automatically:

acquiring a liquid mixture, the mixture comprising a macromolecule, one or more rough components that are larger than the macromolecule, and one or more fine components that are smaller than the macromolecule;

creating a liquid sample, the sample comprising the macromolecule, by separating from the macromolecule at least a portion of the components by applying the mixture to each of a plurality of filters, with a pressure differential across each filter, the filters comprising a rough filter selected to separate at least a portion of the rough components and a fine filter selected to separate at least a portion of the fine components; and

supplying the liquid sample through a valve to an inlet chamber to place the sample in fluid communication with a capillary electrophoresis column, the chamber having one end of the column fixed at the interior of the chamber, and the column having a length of at least about 20 centimeters.

39. A method for capillary electrophoresis, comprising automatically:

acquiring a liquid mixture, the mixture comprising a macromolecule and one or more salt components;

creating a liquid sample, the sample comprising the macromolecule, by separating the macromolecule from at least a portion of the salt components, by applying the mixture to a filter with a pressure differential across the filter and

supplying the liquid sample through a valve to an inlet chamber to place the sample in fluid communication with a capillary electrophoresis column, the chamber having one end of the column fixed at the interior of the chamber, and the column having a length of at least about 20 centimeters.

40. A method for capillary electrophoresis comprising automatically:

acquiring a liquid mixture, the mixture comprising a macromolecule and one or more cells;

lysing at least a portion of the cells; and

creating a liquid sample, the sample comprising the macromolecule, by separating from the macromolecule at least a portion of components larger than the macromolecule, the components comprising insoluble lysed cell components, by applying the mixture to a filter with a pressure differential across the filter; and

supplying the liquid sample through a valve to an inlet chamber to place the sample in fluid communication with a capillary electrophoresis column, the chamber having one end of the column fixed at the interior of the chamber, and the column having a length of at least about 20 centimeters.

41. A method for capillary electrophoresis, comprising automatically:

supplying a liquid sample through a valve to an inlet chamber to place the sample in fluid communication with a capillary electrophoresis column:

the chamber having one end of the column fixed at the interior of the chamber;

the column having a length of at least about 20 centimeters; and

the sample comprising a macromolecule;

directing fluid through the column by creating a pressure differential between the inlet chamber and an outlet chamber, the other end of the column being fixed at the interior of the outlet chamber;

independently controlling the fluid lever in each chamber by:

sensing the fluid level in each chamber;

supplying a buffer to each chamber; and

directing liquid from each chamber to a waste site; and

electrophoretically separating the macromolecule in the column by applying a voltage differential across the column.

42. The method of Claim 41, further comprising detecting the macromolecule.

43. The method of Claim 42, further comprising:

acquiring a liquid mixture, the mixture comprising the macromolecule, one or more rough components that are larger than the macromolecule, and one or more fine components that are smaller than the macromolecule;

creating the liquid sample, by separating from the macromolecule at least a portion of the components by applying the mixture to each of a plurality of filters, with a pressure differential across each filter, the filters comprising a rough filter selected to separate at least a portion of the rough components and a fine filter selected to separate at least a portion of the fine components.

44. An apparatus for capillary electrophoresis, comprising:

means for automatically supplying a liquid sample through a valve to an inlet chamber to place the sample in fluid communication with a capillary electrophoresis column, the chamber having one end of the column fixed at the interior of the chamber, and the column having a length of at least about 20 centimeters; and

means for causing electrophoresis in the column.

45. An apparatus for electrophoretic separation of a macromolecule, comprising:

a plurality of valves;

a rough separation circuit comprising a rough pump, a first stage rough filter selected to separate rough components, and a second stage rough filter selected to separate rough components that pass through the first stage rough filter;

a fine/desalination circuit, comprising a fine pump, a reservoir that supplies a desalination buffer, and a fine filter s selected to separate fine components from the macromolecule;

a denaturation circuit comprising a denaturation pump, a denaturing vessel comprising a heating element and a cooling element, a precipitation pump, a reservoir supplying a denaturation buffer, a reservoir supplying a pH buffer, a pH sensor and a precipitation filter selected to separate insoluble denaturation precipitate components;

a capillary electrophoresis circuit comprising

an inlet chamber and an outlet chamber, the chambers each comprising an inlet valve, an output valve, a fluid level sensor, and an electrode, the electrodes coupled to a power supply;

a capillary electrophoresis column, having a length of at least about 20 centimeters, the opposite ends of the column being fixed at the interior of the respective chambers;

a buffer reservoir supplying the chambers;

an automated controller in electronic communication with the pumps, the elements, the valves, the sensors and the power supply that controls the apparatus to:

acquire a liquid mixture from a sampling site, the mixture comprising a macromolecule, rough components, and fine components;

separate at least a portion of rough components from the macromolecule in the rough separation circuit;

separate at least a portion of fine components from the macromolecule in the fine/desalination separation circuit, the fine components comprising salt components;

denature the macromolecule in the denaturation circuit; and

electrophoretically separate the denatured macromolecule from other components by employing the capillary electrophoresis circuit.